Brainbox learn easy

Unit 1

The Solid State

Packing efficiency-Simple cubic:

In simple cubic unit cell, particle meet along edges,

If 'a' is edge length of the unit cell,

'r' is radius of sphere

a = 2r

No of particles in simple cube = $8 \times \frac{1}{8} = 1$

Packing efficiency = $\frac{\text{No.of particles} \times \text{volume of sphere}}{\text{Total volume of unit cell}} \times 100$

$= \frac{1 \times \frac{4}{3}\pi r^3}{(2\pi)^3} = 52.4\%$

Void space = 100 – 52.4 = 47.6 %

Calculations involving unit cell dimensions:

If 'a' is the edge length,

'Z' is the no of particles

'm' is mass of an atom

Density of the unit cell (ρ) = $\frac{\text{Mass of the unit cell}}{\text{Volume of unit cell}} = \frac{m}{v}$

$m = \frac{ZM}{N_A}$ (M is molar mass)

$v = a^3$

$\Rightarrow$ Density, $\boxed{\rho = \frac{ZM}{a^3.N_A}}$